

**NATIONAL JUNIOR COLLEGE**  
**SH2 PRELIMINARY EXAMINATION**  
Higher 2

CANDIDATE  
NAME

SUBJECT  
CLASS

REGISTRATION  
NUMBER

**CHEMISTRY**

**9647/02**

Paper 2 Planning Question

**Wednesday 24 Aug 2016**

Candidates answer on the Question Paper.

Additional Materials: Data Booklet

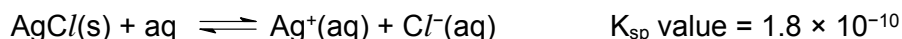
<b>READ THESE INSTRUCTIONS FIRST</b>  Write your subject class, registration number and name on all the work you hand in. Write in dark blue or black pen. You may use a soft pencil for any diagrams, graphs or rough working. Do not use paper clips, highlighters, glue or correction fluid/tape.  Answers <b>all</b> questions. A Data Booklet is provided.  The number of marks is given in brackets [ ] at the end of each question or part question.	<b>For Examiner's Use</b>	
	<b>1</b>	<b>/12</b>
	<b>Total</b>	<b>/12</b>

Answer the question.

## 1 Planning (P)

The solubility of silver chloride at a particular temperature, is defined as the mass of silver chloride that can dissolve in and just saturate 100 g of a solvent at that temperature.

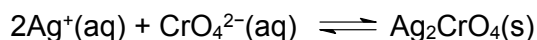
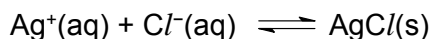
In a *saturated* solution in contact with undissolved solid, the following equilibrium is established:



- (a) A student was tasked to investigate the concentration of chloride ions in a sample of sea water from the East Coast Park. Keeping in mind the low solubility of silver chloride, she carried out her investigation through a method known as precipitation titration, which is useful for reactions that yield ionic compounds of limited solubility.

In her investigation, solutions of chlorides were titrated with aqueous silver ions in the presence of chromate ions. The end point of the titration occurred when almost all the chloride ions have been precipitated and is signalled by the appearance of brick-red silver chromate precipitate,  $\text{Ag}_2\text{CrO}_4$ .

The reactions are as follows:



From the stoichiometry and amount of reactants used, the amount of chloride ions in the sample of sea water can be determined.

Using the information given above, you are to plan an experiment to determine the concentration of chloride ions in the sample of sea water.

You may assume that you are provided with:

- a sample of  $250 \text{ cm}^3$  of sea water of approximate chloride concentration of  $2.0 \times 10^{-3} \text{ mol dm}^{-3}$
- $1.00 \text{ mol dm}^{-3}$  potassium chromate(VI) solution,  $\text{K}_2\text{CrO}_4$
- $0.1 \text{ mol dm}^{-3}$  silver nitrate solution
- deionised water
- the apparatus normally found in a school or college laboratory.

Your plan should include details of:

- preliminary calculation to decide if the silver nitrate solution provided is suitable for use in the titration
- preparation of a standard silver nitrate solution from the  $0.1 \text{ mol dm}^{-3}$  silver nitrate solution provided, if necessary
- appropriate quantities of solutions
- all essential experimental details
- an outline of how the results would be used to determine the concentration of chloride ions in the sample of sea water

[illegible]

[illegible]

**[Turn over**

- (b) The student obtained a titre volume of  $20.60 \text{ cm}^3$  from her experiment. Determine the concentration of chloride ions remaining in the solution at the end point. You may assume the following:

- $25.0 \text{ cm}^3$  of sea water was used in the titration
- $1 \text{ cm}^3$  of  $1.00 \text{ mol dm}^{-3}$  potassium chromate(VI) solution,  $\text{K}_2\text{CrO}_4$  was used as the indicator
- $K_{\text{sp}}$  value of  $\text{Ag}_2\text{CrO}_4$  is  $1.1 \times 10^{-12}$

- (c) Subsequently, the student investigates the solubility of silver chloride in aqueous hydrochloric acid. [2]

By considering the ions present in a solution of silver chloride in aqueous hydrochloric acid, predict and explain how the solubility of silver chloride will be affected by the concentration of the acid.

Prediction:.....

Explanation:.....

.....

.....

.....

[2]

- (d) Identify the following variables in the investigation of solubility of silver chloride in hydrochloric acid.

Independent variable: .....

Dependent variable: .....

[1]

- (e) Calculate the solubility of silver chloride in a  $2 \text{ mol dm}^{-3}$  hydrochloric acid solution.

[1]

**[Total: 12]**